DOCUMENT RESUME

ED 077 564 PS 006 488

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TITLE	The Instructional Environment and the Young Autonomous Learner.
INSTITUTION	California Univ., Los Angeles. Early Childhood Research Center.
SPONS AGENCY	Office of Economic Opportunity, Washington, D.C.
REPORT NO	OEO-CG-9938
PUB DATE	72
NOTE	46p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Classroom Environment; *Early Childhood Education; Educational Research; *Instructional Design; Learning Activities; *Learning Laboratories; *Learning Processes; Self Directed Classrooms; Student Motivation; Technical Reports
IDENTIFIERS	*Project Head Start

ABSTRACT

The study of goal-directed learning through the design of components in the environment is reported. Particular emphasis is given to the way the child uses informational resources to attain an educational goal, i.e., the question of how children seek and use available information. The data gathering procedures ranged from the development and use of fairly precise testing devices to informal observations of children's reactions. The research strategy was to move back and forth from studies of the learning center in a controlled laboratory context to those in an open classroom environment. Three types of questions were raised in studying this interface between the child and the instructional environment: (1) children's strategies of information-seeking and use, (2) effectiveness of the learning center in terms of immediate learning outcomes, and (3) possible long-range outcomes. The major unit used for the studies was a learning center which posed a paired-associate learning task. Studies with Head Start children in the laboratory and using the laboratory in a classroom setting are described. Wide individual differences were found in the way young children engaged in self-prompting. Although there was no definite evidence obtained, it seems plausible that the way children attack this task of self-instruction reflects broader personality patterns. The learning center was of considerable interest for most of the young children, being in use from 75% to 100% of the time; it was also effective as a means for self-instruction for a large proportion of these children. (DB)

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THE INSTRUCTIONAL ENVIRONMENT AND THE YOUNG AUTONOMOUS LEARNER

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1972

PS 006488

This study was carried out through the UCLA Center for Research in Early Childhood Education, sponsored by the United States Office of Economic Opportunity, Contract No. CG 9938, Dr. Carolyn Stern, Director.

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Introduction

It is an old notion that learning proceeds best when the student takes the initiative in setting his goals and pursuing his education in ways that makes sense to him. Rousseau's Emile learned his lessons from nature itself, a theme of self-directed education, reflected by Pestalozzi and Froebel, which found one form of expression in the progressive education movement launched by John Dewey. In fact, some of the so-called experimental schools responded to the concept of child interest and demand to such an extreme that it called forth criticism from Dewey himself.

Thoughtful educators have sought to foster the growing independence of their students as learners and though their approaches varied widely, there appear to have been notable successes for reasons we do not understand. In recent years, a whole host of factors within different cultural and philosophical frameworks have led to varied expressions of this idea under labels such as "individualized instruction," "the free school," "open structure," or "learner-controlled education." A common theme in all of these approaches is that of autonomy, the recognition that the learner exerts his own control over the instructional process.

At a philosophical level, of course, there is considerable debate on the question of autonomy. Skinner (1971) in his hotly discussed recent book, Beyond Freedom and Dignity, has stated in no uncertain terms

that in the final analysis there is no such thing as autonomy. He equates this concept with the superstitious idea of the homunuculus in man. Since everything we do and are may be traced back to antecedent events, the concept that man can make his own decisions in the sense of being really free to do so is meaningless. For Carl Rogers (1969), the fact that man is both free to choose and still bound by determinism is accepted as a paradox--one that we must learn to live with. Other writers who have joined the fray include a variety of hostile critics such as Toynbee and Chomsky. John Platt (1972), in his cogent effort to reconcile the conflict between Skinner and the humanistic school, regards these two points of view as two sides of a coin. Platt concludes his review by saying "For the solutions of our deep problems, in the long run, Skinner's manifesto is the only hope we have." If Jensen crystalized the issue for the Sixties, Skinner's Beyond Freedom may well be the issue of the Seventies.

At a practical classroom level, we may define the autonomous learner as one who makes the decisions relating to his own learning process. He decides what he will learn and how he will learn it and when he will turn to other pursuits. Although in every classroom some form and degree of autonomy is permitted the learner, the variation is enormous. At one extreme, learners are given only limited opportunities to be autonomous, by selecting a topic for a paper or studying the required assignment in their own way. At the other extreme, the only constraints placed upon the learner is that of safety (for himself and his peers) and limits protecting the rights of others.

For many writers the feature of learner independence is a goal to be sought in and of itself; it represents a basic assumption about human existence. For others, learner-controlled instruction is defended because it is, in practice, more effective in the attainment of broad outcomes. Where specific outcomes are at stake, the research literature is unclear as to what extent learner control of the instructional process is desirable. Such ambiguity is understandable simply because of the host of factors which are necessarily involved.

Part of the problem hinges on the inadequacy of the definition proposed. How can we ever tell when a learner makes his own decisions in school? Some years ago on the opening day in September, a fourth-grade teacher in a progressive school designed the classroom so that, when the children arrived, they found over in one corner a set of musical instruments from Mexico; elsewhere was spread out a variety of Mexican costumes for the children to try on; in another corner a display of metal handicrafts from Mexico was carefully arranged; and on the back wall was a sample of breath-taking pictures of beautiful Mexican scenery, village life and growing cities. On arrival the children had a marvelous time for a good fifteen minutes, banging on drums, trying on costumes, playing the musical instruments, fingering the handicrafts, and gazing at the beautiful pictures. At the end of fifteen minutes the teacher assembled the class and, after they had finally quieted down, said, "Well, this is a democratic classroom. What would you like to study this fall?" The vote was unanimous. It is difficult to ascertain whether the children or the teacher, or both, made the decision.

It does seem obvious that where the learner is offered no alternatives he is not likely to be making his own decisions. Nor can we be satisfied with a stacked set of choices from which to choose. Harold Carter, at the University of California, Berkeley, told the story, years ago, that he had discovered an excellent way to get his son to eat his cereal. He would pose the question brightly in the morning, "Do you want to have your cereal in the red bowl or the green bowl?" The young man was so preoccupied with these alternatives that he failed to consider the third possibility of no cereal at all.

While the learner must be given a genuine range of real options, such choices cannot be infinite and teacher influence in the selection is inevitable. To say that the environment must be a natural one, the real world, such as the school without walls, is an exciting point of view; but it does not solve this problem. Teachers, no matter how non-directive they wish to be, still influence their students and have something to do with the way students' decisions are made. Any discussion of the autonomous learner must deal with the nature of the educational setting.

One of the most valuable ways of describing the instructional environment, from the point of veiw of research, has been the model proposed originally, I believe, by Robert Glaser (1962). The model involves first setting objectives; second, assessing the present state of the learner; third, devising an instructional sequence; and, finally, evaluating the outcome. This four-fold set of categories is extremely flexible and has found a wide range of applications. One adaptation for the autonomous learner is presented in Figure 1. Across the top of this

diagram are presented in modified form the four steps of Glaser's instructional model, with the learner presented as the decision maker. Although this reflects a problem solving framework, it includes the possibility of learning as a result of unplanned exploration or as an unintended product of other goal directed activity.

Teachers hope that the production activity involved in building a teepee, putting out a newspaper, or handing in a term paper is evidence of learning.

The role of the teacher is reflected in the lower set of boxes in Figure 1, which are focussed upon the environmental resources necessary to provide the richness of opportunity for the learner. An important part of such resources is the opportunity to learn to make better decisions. Teachers frequently resist giving pupils the freedom to choose their own instructional goals because they fear that the child is unable to make "wise choices". By offering better opportunities to learn the consequences of different options, for example, children's decisions about goals may be more mature.

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The instructional environment of the young learner

The instructional point of view expressed in Figure 1 is highly congruent with the practices found in most preschools. In fact, it has been frequently pointed out that changes in the elementary school (e.g. the emergence of the British Primary School) have been strongly influenced by the institution of the preschool. The study of the autonomous learner and the instructional

environment may be particularly valuable at a young age where the impact of formal school experience is absent.

From the standpoint of instructional research, it is important that summative evaluations be carried out to assess long range programs involving different degrees of learner control. The evaluation of Planned Variations represents such an approach which is currently underway at the Head Start level. It is even more important, however, to study the various components of instruction to discover how the best program may be improved. Yet it is difficult to isolate for separate experimental study individual features of the open instructional environment where in the interplay of a host of factors, the usual experimental controls are absent. The most important and complex variable, the teacher, has been the object of considerable study particularly at the descriptive level. Recently, for example, Resnick (1971) fruitfully recorded and analyzed the verbal behaviors of teachers in the British Primary School during sample periods of the school day. Less significant, but more amenable to experimental study are the material resources in the environment.

A global assessment of the value of the instructional materials in the classroom has not been greatly encouraging. Busse and his associates (1970) tested the effect of enriching the physical environment with about one hundred Head Start children who were randomly assigned to control and experimental classes. In each of the experimental classrooms was placed $1300 worth of equipment including such things as tape recorders, farm animals, magnets, wooden puzzles, record sets, dolls, puppets, and so forth.

Observation of the two groups of classes revealed no differences in the way in which teachers interacted with the children or the encouragement given children to use the available materials. However, the control children were as likely to be superior as the experimental, providing no support for the notion that simply enriching the environemnt through more materials has any value.

It is probably more fruitful to study small segments of the instructional environment. One promising component is the learning center. Here the young child encounters a set of materials in one part of the classroom. Hopefully, these are appealing and designed more or less as a unit. An essential feature is the fact that the child may choose whether or how much to play at the learning center, and that he may undertake the activity "on his own." Where an adult creates the interest center, it represents the independent variable; of course children frequently modify existing interest centers or create new ones of their own. The dependent variables are reflected in the way children react to such centers and the resultant learning outcomes.

From the point of view of instructional research, the interest center is analogous, therefore, to an instructional program. For example, to teach the concept of diagonality, Olson (1970) introduced apparatus into the classroom environment of the young child. The preschoolers were free to play with the materials as they chose during the school year. At the end of this period, these youngsters, in comparison with control children, showed a superior grasp of the concept.

It is desirable that the child encounter interest centers which

vary in a multitude of ways. (See publication titled Learning Centers: Children on Their Own, Association for Childhood Education International, 1970, Washington, D. C.) One important dimension is the extent to which the center sets a problem for the child as compared to an open-ended activity. For example, play materials, such as painting or blocks, offer an infinite variety of options where no specific goal is presented. Such open-ended activity permits a wide range of novel responses. On the other hand, the didactic Montessori materials tend to pose problems geared to the maturity level of the child, who is able to determine for himself whether or not he has attained the appropriate solution.

The general problem

This general framework for conceptualizing the process of autonomous learning within a research strategy, has been applied to a number of studies carried out at the UCLA Early Childhood Research Center. The focus has been upon young learners, four and five year old children in Head Start classes. These explorations represent an attempt to view different aspects of the way young children relate to one instructional resource. All of these investigations, successes and fiascos alike, have contributed helpful insights.

Our program has focussed upon the study of goal-directed learning through the design of components in the environment. Particular emphasis has been given to the way the child, on his own, uses informational resources to attain an educational goal, i.e. the question of how children seek and use available information. The approach involved methods more

like those of formative evaluation than classical experimental design. The data-gathering procedures ranged from the development and use of fairly precise testing devices to informal observations of children's reactions.

The research strategy was to move back and forth from studies of the learning center in a controlled laboratory context to those in an open classroom environment. After the first version was tried out at a preschool center and revised, a more controlled laboratory study was undertaken. Then the center was moved into the classroom to note what happened under typical classroom conditions. With new questions raised, another laboratory study was called for before returning to the classroom once again. While the procedure sounds more organized than it has been, the plan of moving back and forth from laboratory to classroom has seemed helpful.

Three types of questions were raised in studying this interface between the child and the instructional environment:

1. Children's strategies of information-seeking and use. How do children go about using an information source for their own self-instruction? What self-management skills or learning strategies are effective? Are such strategies a function of individual personality variables such as independence or achievement motivation? To what extent do peers act as a source of information?

2. Effectiveness of the learning center in terms of immediate learning outcomes. How much is learned in terms of the instructional goal, by what proportion of pupils? How much is the activity at the learning center enjoyed or preferred?

3. Possible long range outcomes. Are experiences at the learning center likely to foster development in self-reliance and independence in learning? On this last question we can offer some speculations but little data.

In designing a learning center as the independent variable for study, a number of criteria were adopted: (1) The center must offer children a clear instructional goal; it must supply evidence that the learner is making progress toward that goal. (2) The center must appeal to most young children so that, without special encouragement, they will initiate activities at the center. (3) What the child does while manipulating materials must be sufficient to maintain motivation to demonstrate learning; extrinsic sources of reinforcement such as teacher approval should not be necessary. (4) The center must provide children with opportunities to make decisions about their own instructional processes, such as control of sequence, seeking information, and self-evaluation. (5) There should be an opportunity for the learner to adjust the difficulty of the tasks and subtasks. (6) The center should require no monitoring on the part of the teacher. It should be a self-contained independent area of the classroom.

The measurement of preference for school activities

It is difficult in a laboratory setting to estimate the extent to which children like or enjoy what it is they are doing in the experiment. Those of us who have taken subjects out of a classroom for our studies are pleased every time we enter the room and hear the voices of half a dozen children asking to be next. However, it is even more important to

find out if the children who have already been included want to come back again. Apart from the uneasy feeling that the vocal few are not representative of the class, we also wonder whether this apparent enthusiasm reflects the child's desire to escape from an uninteresting classroom activity.

The importance of providing instructional resources which children will voluntarily seek and use has caused us to pay a good deal of attention to the problem of measuring the child's preference for activities in school. What is needed is a simple, easy-to-administer instrument. Of course, the most valid test would be the extent to which children actually relate to materials in a free classroom setting; but getting this information requires procedures which are too time consuming for the developmental phase of a learning center.

We have explored a number of methods for obtaining a systematic measure of preference of activities with young children (Keislar, 1971). In one study we tried out a distancing technique based on an approach-avoidance concept, illustrated by a child pushing away a food he doesn't like. If children enjoy an activity, presumably it is one that they would approach. Pictures of activities drawn on cards were placed upright on a stand. The child was asked to arrange these in front of him in any way he chose, putting some farther, some closer. We hoped that he would put the activities he preferred physically close to him and others farther away. But the procedure did not work. Children placed the pictures either equidistant or at random. There was no consistency in their placements.

We were somewhat more successful when we asked the child to position three pictures in terms of a rating scale, the one he liked best close to him and the one he didn't like farthest away, but there was little evidence that the child was indicating his preferences in any reliable fashion.

The final form of the preference test was an adaptation of one developed in an earlier study (Keislar & McNeil, 1960). Using a paired-comparison technique, the child is presented with a succession of pairs of pictures, each one showing a child engaged in a familiar school activity. Separate forms have been developed for each sex. As each pair of pictures is shown to the child, he is asked, for example, "Do you like to play with blocks or do you like to play with toys? Point to what you like to do best."

The test has been "standardized" in such a way that it is possible to assess the preference for any new activity which may be involved in an investigation. In this case, the new procedure is compared with five standard activities, which are generally found in schools: playing with blocks, looking at picture books, painting, playing with toys (cars and dolls) and assembling puzzles. The preference scores range therefore from 0 to a maximum of 5, depending on how many times the new activity was preferred over the standard ones. To save time in administering this preference test, we have used eight pairs of pictures, omitting several pairs which compared two of the standard activities.

In order to find out whether Head Start youngsters were indicating their "real" preference with such an instrument, a validity study was con-

ducted. Twenty eight Head Start children were given the paired-comparison test, involving only the five standard activities. The child was then led to one side of the room where the materials needed for each of these activities had been previously placed behind screens. The materials were borrowed from the child's own classroom. The screens for two activities, the one most preferred by the child and one least preferred, were then removed. The child was invited to play with one of these activities for a "little while" before returning to his class. All youngsters readily selected an activity and stayed to play. How well did the picture preference test predict the actual choice? In 75% of the cases; this figure was interpreted as indicating an acceptable level of validity for the test.

Information seeking

Although many learning centers offer a medium for expression and a fulfillment of many social and personal needs, other centers in the classroom are important because they offer the young child an opportunity for exploration and consequent contact with an information-rich environment. The child acquires not only specific information in this way but he "learns to learn" through the cultivation of covert attentional habits and a variety of self-management skills.

A child's exploratory activity at a learning center may reflect the competence motive of White (1959) or the "will to learn" proposed by Logan (1971). At some centers, such exploration may simply be referred to as curiosity, to follow Berlyne's suggestion (1960), since it does not appear related to any goal. On the other hand where a particular instructional

task is posed by the center, the child engages in purposeful information-seeking activities. Following the formulation in Figure 1, the center should provide appropriate resources to permit this self-instruction to proceed.

As part of his growing competence in information seeking, the child learns to recognize when he needs information, to seek it out, and to use it for the attainment of his goals. When the information source has served its purpose, hopefully he discards it. A learning center should be designed to facilitate this growth in learning abilities. Informal observations of children during such self-instruction have suggested, however, that children make two types of errors. Some adopt a trial and error strategy making little use of available information; they act as if they hope to win by luck. Others appear to rely too much on the information source in what seems to be an overcautious pattern of behavior.

In an earlier study, these two types of errors appeared where kindergarten children sought and used information in teaching themselves to speak French (Bland & Keislar, 1966). The subjects learned to describe pictures drawn on Language Master cards by saying appropriate French sentences (formed by using one each of five nouns, five adjectives, and five predicates). By playing a card on the Language Master, each child could hear the correct sentence for the picture on that card. In this way it was possible for each child to obtain information whenever he wanted it. The criterion test consisted of pictures which the child had

not seen before but which were to be described by sentences involving new combinations of the words he had learned. Most of the children learned to speak a good deal of French in this way. However, even after one recognizes variations in rate of learning, there appeared to be large differences in the extent to which the Language Master cards were used.

Over-reliance on an information source may be viewed as a form of self-prompting to an extreme. In a now classic study, Gates (1917) showed the inefficiency of over-prompting for the learning of factual materials. More recent work in programmed instruction (Anderson, Faust, & Roderick, 1968; Markle, 1969) provide similar conclusions.

On the other hand, failing to take advantage of available information may mean excessive use of trial and error, a strategy likely to be adopted by younger children (Munn, 1954). It is of interest to note that Weir (1964) found that where only the simplest strategy was appropriate younger children did better than older. Kagan and his associates (1964) have pointed out that the impulsive child, who is more likely to adopt a trial and error approach, is going to face failure far more often.

The Learning Center: The Animal Game

With a simple goal the child is likely to be more aware of what is called for and the child's self-instructional processes are more easily observed. Consequently, the major unit used for the studies was a learning center which posed a paired-associate learning task. This associative learning is not unlike much of what is included in the preschool curriculum. For example, such outcomes constitute a large part of the preschool television program, Sesame Street.

The instructional goal for the center was to learn where each of nine animals lived by matching a picture of the animal with a picture of its habitat. For example, when a child was faced with a picture of a seal, he picked a picture of a rocky ocean coastline; for a monkey, he picked a jungle scene. This task both appealed to children of this age and is not ordinarily taught as part of the preschool curriculum. With very few exceptions, on the pretest Head Start children performed only slightly above chance.

The apparatus consisted of a wooden box with a sloping top, a set of nine animal pictures, and a reference book. The habitat pictures were mounted on the top of the box in three rows, three pictures per row. At the bottom of each habitat picture was a keyed slot into which could be inserted any of the nine cards, but only to the depth of one-quarter inch. Keyed strips on the back of the cards permitted only the correct animal picture to pass through the slot for a habitat. When the child had put all the animals where they lived, he could retrieve the cards by pulling open a door at the front of the box and play the game again.

To permit the child to seek and obtain the information he needed for this activity, a picture reference book was placed on a stand beside the game box. Nine reference tabs at the side of the book, each one showing a picture of the animals, permitted the child to look up the habitat of the animal and thus prompt himself whenever he wished. When he pulled a tab to open the book, he found the corresponding picture of a habitat. Thus, by simply matching the pictures he could place each animal card in the proper habitat slot. This idea of "looking up" something in a book

was a new one for the youngsters; consequently a separate, much more simple, task was developed as a preliminary game to help the children learn how to use such a reference source. In this orientation, pictures of different animals and a corresponding different reference book were involved.

Effectiveness of a trial-and-error strategy

A laboratory study was first conducted to see whether four- and five-year-old Head Start children could use these reference materials to learn effectively (Keislar and Phinney, in Press). It was hoped that the youngsters would move from chance performance on the pretest to a 90 percent criterion, one error or less on the posttest. It was also hoped that the game would be sufficiently interesting to young children so that, on the picture paired-comparison preference test previously described, they would select the experimental activity more often than most of the standard activities presented.

In addition to the critical question as to whether children could easily learn to use this reference book system as a source of information in mastering these paired associates was the question of whether children could learn just as well by using a simple trial-and-error method. Since the apparatus described permitted knowledge of results, it was not inconceivable that children could learn by simply trying each card in one slot after another. We wanted to make sure that children were not rewarded for resorting to this strategy.

Fourteen Head Start children, randomly assigned to two groups, came individually to a room adjacent to their class for a daily session lasting about 10 to 12 minutes over a three day period. The trial-and-error group had no access to the reference book but were encouraged to use the knowledge of results from each try. The information-seeking group were shown how to use the information source which was at first required, then made optional and, for the final round, removed.

The results showed clearly that the trial-and-error strategy was fairly ineffective. Although posttest performance of the group was definitely above chance levels (M=5.6 out of a possible 9), it did not approach the almost perfect performance of the group which used the reference book on a gradually fading basis (M=8.4). On the preference test, most of these subjects rated the activity as their first or second choice out of the six activities presented. As might be expected, one apparent reason for the poor performance of the trial-and-error group was simply that they spent less time looking at the pictures (something which the information-seeking group had to do to locate and use the information available) and more time "hunting" for the right slot.

Using incentives to optimize an information-seeking strategy

Observations of children playing the animal game revealed the usual wide range of individual differences in reliance on the information source. Although there was no conclusive evidence that children were making such errors, it appeared that some were relying entirely too much on the book and were thus overprompting themselves while others were using excessive amounts of trial and error and thus underprompting. It was hoped, of course, that children using such materials would be encouraged to avoid wild guessing but would be willing to make a try when reasonable mastery

had been attained. It seemed plausible that heightening the incentive to reduce such extreme behavior would foster more effective learning.

Ten Head Start children participated in this next experiment. Each child came in for an individual session once a day for three days. Following procedures found to be effective in earlier studies, (cf. Keislar, 1960; Lipe & Jung, 1971), marbles were used as incentives. For each reinforcing event, the child recieved a marble which he placed in a tray in front of him. As he played, the marbles he received thus formed a bar graph to remind him of his growing success. To avoid a policy of giving prizes, the children were told that they could not keep the marbles.

Half of the children, the experimental group, were differentially reinforced only when they placed the card correctly on their first try without using the reference book; this performance was precisely the same behavior called for on the posttest. Every child earned at least one and usually several marbles on each round of the game. The children in the control group were indiscriminately reinforced; they received marble when each card was correctly placed regardless of what they did to get it there. Theoretically, a child in the control group could get reinforced consistently without learning anything.

The results showed, quite contrary to our expectations, that the control group (M=8.0) did significantly better than the experimental (M=4.6)! The use of special incentives had failed in producing better learning. How did the youngsters in this study use the reference book? Subjects in both groups showed a decreasing reliance on the book; in other words, they were indeed fading their own prompts (see Figure 2). However, the experimental group, if anything, seems to have used the book slightly more than the control. It is clear that there is no support for the hypothesis that placing a premium on becoming independent of the information source weaned these youngsters from the reference book any

faster. It is also of interest to note that the standard deviation in the use of the reference book was more than three times as large for the experimental group than for the control.

The second study clearly indicates that providing extrinsic incentives was ineffective, in fact, even damaging to learning. One plausible explanation of this reversed finding was that the children in the differential reinforcement group were clearly under greater pressure to learn rapidly and do well; risks were involved. The challenge affected the children differently. For the group as a whole the interfering effects of this risk situation may have been relatively large. On the other hand, the children in the indiscriminate reinforcement group, in a more secure and rewarding atmosphere, may have been better able to attend to the task. It was concluded that the individual reactions to external motivating conditions differ so much that it may be better to let the child judge how much to rely on the book!

The classroom setting

With some assurance that the procedures were effective and that the activities held some appeal, the learning center was placed in an open classroom setting. The main problem was simply to find out how much, if at all, children would learn when given the opportunity to play the game under minimal controls. The animal game was therefore placed successively in three different Head Start classes in East Los Angeles for four days each. Teachers were requested to treat this center just like any of the other sets of materials in the classroom with one exception: they were not to coach the children on the task. Otherwise, no constraints were placed on how the children would use the materials.

In these studies, all efforts were made to keep things as natural as possible by reducing all external influences to a minimum. Nevertheless, the conduct of the research demanded some interference. Since it seemed

necessary to find out how much these youngsters knew about the task before contact with the learning center, pretests were given to two of the classes. In the third classroom, however, to eliminate the possible effect of such a test experience prior to the "treatment", no pretest was given. Furthermore, to avoid the possibility that children would "play up" to an observer, in two of the classrooms no systematic observations were made; instead, an assistant dropped in occasionally just to make sure that things were going along smoothly during the four day period. In the third classroom, however, an observer was constantly present to keep a record of everything that went on. On one occasion, pictures were taken in this room. There was no evidence, however, that the presence of the observer made any difference.

The necessity for orientation was also a problem in the attempt to study the learning center under "natural" classroom conditions. We had found that, without some kind of orientation on the use of the reference book, Head Start children would rely on trial and error. Yet, we wanted to hold such external instruction to a minimum. The compromise solution was to provide orientation for a small proportion of the group, hoping that the rest would learn what to do form the initiated minority. The orientation game, as previously described, was given to one third of the youngsters before being introduced into the classroom. In spite of our efforts to obtain a random sample from this Mexican American population, somehow the youngsters who showed up for orientation were better at speaking English than the rest of the sample and performed slightly better on the pretest. Although, we were probably fortunate in having better communication during orientation, our conclusion about the value of orientation is confounded. Oriented youngsters showed slightly higher scores on the posttest but we can not be sure why.

In the one monitored classroom, the game was in constant use

during the first two days and used 90 percent of the time during the last two. As would be expected, wide individual differences in participation were found; although the average child played the game five times (taking a total of 17 minutes), some never played and one played 10 times.

Test results for the three classes, shown in Figure 3, are based on all children regardless of their participation. The available pretest scores average slightly above chance. It should be noted that while the posttest means of the three classes are all between 5.5 and 6.0, approximately one third of the youngsters in each class reached the criterion of no more than one error. Because the children interacted freely with each other, the classroom is the appropriate experimental unit. Since this leaves an N of 3, no statistical tests were conducted. It appears, however, that a large proportion of children in each class showed evidence of learning to a high criterion.

How did the children use the reference book in this uncontrolled free situation? In our laboratory study there was a consistent decrease in the use of the book across six rounds (Figure 2). The children in the observed classroom played the game in an average of five rounds. Did they use the book less and less as they learned? Since different children played different numbers of rounds, to answer this question a Vincent curve was constructed. The graph indicated little evidence that on the average these children were "fading the prompt" under these conditions, although a few youngsters seemed to rely on the book sparingly. Some children who played even five to ten times used the book heavily throughout; they seemed simply to enjoy turning the pages and looking up the animals. The materials were being used for something more than mastering the task the experimenter had in mind!

Individual differences in style of information-seeking

The puzzling differences in the way in which children sought or did not seek information from the reference book led to a number of speculations similar to those offered in explanation of the results of the incentive study reported earlier. Was the anxious, dependent child relying heavily on the reference book and thus, by making the task easier, avoiding failure? Was it the fast-responding, impulsive child who rarely sough to use the book and presumably counted on luck to accomplish the task? Did the high achievement-motivated youngster, as the literature suggests, make the task into a challenging one of moderate difficulty by using the book only when he seemed to require it? Answers to these questions would be helpful in designing effective learning centers.

Previous research suggests the plausibility of the hypotheses posed by these questions. For example, Gratch (1964) found that dependent children, as rated by their teachers, make the same kind of guesses on a task as independent children, but are much less willing to wager on their guesses. Kagan (1966) has identified a behavior syndrome for the impulsive child, the youngster who acts quickly without carefully reflecting on the alternatives. A wide range of literature also suggests that even among young children differences in achievement motivation may be observed; children differ reliably in the extent to which they will seek tasks of intermediate difficulty where there is a moderate risk of success and failure (cf. Crandall 1969 ; Veroff, 1969).

In our next study, in which 20 children played the game individually under laboratory conditions, the focus was upon the development of various measures related to the strategy of information-seeking and use. A critical factor seemed to be how much a child was willing to play his hunches. In other words, when a subject was not completely certain about where to place a card, to what extent did he seek information to assist him instead of taking a chance?

In simply observing children use the reference source, it is difficult to tell exactly what the child is doing. For example, it is not clear whether children are using the book in spite of the fact that they are practically sure of the right answer or because they are completely uncertain. Neither can one tell whether a guess represents a wild shot in the dark or a highly informed reasonable choice. Since these young children were unable to verbalize the judgments about their own growing competence, it is desirable to obtain during the playing of the game additional information on how well the child has learned the material. Such information does not, of course, give the complete story; a child may genuinely believe he knows the answer when in fact he may be in total ignorance and vice versa. Nevertheless, evidence regarding the child's growing competence is essential in interpreting his behavior of using the reference book .

One method we had previously explored was to have the child play under two different alternating conditions. When a green sign was displayed above the box, the child was allowed to use the book at his option; after two or three such rounds, a red card was shown instead, meaning that the resource book was now unavailable for use. After one "red" round, which essentially constituted a test, the green card was restored. However, the procedure was judged to provide too rough an estimate of competence,

since knowledge of results was constantly available during the test, a child's competence could change before the following round.

A two-step technique, involving a slight apparatus change, was finally adopted. Each child first made a "guess" as to where the animal card belonged by resting the card in the slot in front of the chosen habitat. He could then decide whether to look up the information and perhaps change his guess. When he decided to confirm his choice he pulled a ring at the front of the box; if it was the correct slot the card dropped through. The procedure provided some estimate of the child's learning at each step without giving knowledge of results.

The use of such a two-step procedure permitted the calculation of two kinds of scores to describe styles of information-seeking. Both of these were based on what the learner did after he made a guess, but before he found out whether his guess was right or wrong. (1) Book-reliance was measured by the proportion of times the book was used when the guess was correct. High scores on this measure would suggest over-prompting. (2) Chance-taking, how much the child was willing to gamble, was measured by the proportion of times that he failed to use the book when his guess was incorrect. High scores here are indicative of under-prompting.

Three personality measures were obtained for each youngster. Latency was the average time taken by the child to make his initial guess for each card. Dependence was measured by the use of a teacher rating scale to assess such factors as anxiety, reluctance to face new situations, looking to the teacher for help. As a measure of achievement motivation, an adaptation of Veroff's test battery was devised.

The three questions originally posed led to the following predictions: (1) Dependent children would be likely to over-prompt themselves and thus show relatively high scores on the criterion of book-reliance. (2) Quick-responding, impulsive children would under-prompt and thus get relatively high scores on chance-taking. (3) Children whose achievement motivation is strong would prompt themselves only when the risk of being wrong was high; they would show low scores on both criteria.

The conduct of this study revealed that learning under these procedures was clearly more difficult for the children. Instead of taking only six games to master the task, this group required nine. Even then, as a group, their performance did not equal the almost perfect posttest scores of previous groups under laboratory conditions. Using a procedure similar to the one adopted here, Berlyne and associates (1968) also found that asking children to offer first a guess about each pair made the task of learning more difficult.

Unfortunately, the results showed that the distributions of the two criteria were highly skewed and the reliabilities low. After a guess was made, for most of the children in this group there was a strong tendency to check it out. Book-reliance scores piled up near zero while the chance-taking figures were up at the other extreme. Although there was no other way to assess over-prompting, a substitute measure was used for under-prompting. Chance-taking was estimated by the following procedure: After the child's first guess had been shown to be wrong, the proportion of times he tried again without using the book was noted. Although this measure may suffer from the fact that it may still reflect competence, it showed a high reliability of .90.

The children were highly consistent in the time they took to respond first, the reliability of the measure of latency being .96. The reliabilities of the other two personality measures , dependence and achievement motivation, were not high enough to warrant their use. On the average a child took significantly less time to make a guess which was correct than one which was incorrect. There was a significant relationship between latency and the use of the book when the first guess was wrong ($r = .50$). This finding supports the notion that lack of reliance on the book is part of the impulsive syndrome, although because of the limitation of the measure we must hold it with a reservation. Subsequent efforts to improve these measures have been partially successful but further clarification of these variables is called for.

Peers as Resources for Learning

An important feature of the classroom, sometimes neglected in the preparation of instructional programs, is the presence of constant social interaction throughout a learning sequence. With the learning center, for example, children helped each other, took turns watching and playing, laughed and talked about many irrelevant things. Under these social circumstances the self-instructional behavior of the learners was undoubtedly very different from that observed in the individual laboratory settings. One function of vertical grouping, as in the British Primary School, is that older children are available to orient and assist their peers who may be two or three years younger. In the classroom tryouts of the learning center, this informal teaching function of peers was made use of by orienting only one-third of the class.

During recent years a good deal of interest has been expressed in tutoring, especially through formal procedures whereby older children from higher grades are assigned to work with children in lower grades. In such studies the focus of interest has usually been on the tutor. For example, Gartner and associated (1971) found that elementary school children who were being tutored enjoyed the sessions but did not show more than normal growth. It was the high school tutors who profited by making enormous gains in relatively short periods of time. Frager and Stern (1970) found similar values for cross-age tutoring at the elementary level. Feshbach and Devor (1969) studied the teaching styles of four-year olds as they instructed three year olds. They found that children from middle class families used positive reinforcements more than lower class children.

In one laboratory study, we looked at the process of peer tutoring by four year olds with 16 Head Start children as subjects (Keislar & Blumenfeld, 1972). The structured curriculum, designed to teach prepositions, took the form of a matching game in which the learners identified the pictures described by their tutors and vice versa. The goal was to assess the effectiveness of the procedure by looking at the particular contribution of the tutors. It was possible that children could communicate effectively without ever using the prepositions for which the game was designed. Two groups of tutors were selected, four who knew the material, as demonstrated by their successful passing of a competency pretest, and four who failed the test. Their pupils, who had all failed, were assigned at random. The pairs played the game for four days, 10 to 15 minutes per day.

The results supported the notion that to be a good teacher at the four-year-old level, a person should know his subject. On the other hand, there was evidence to suggest that this is not all; while three of the four pupils with competent tutors learned to a 90 percent criterion, one showed no gain at all. Why? Although her teacher was most qualified in the subject field, he was an arrogant young man who was utterly impatient with the slowness of his pupil's progress and who would vent his displeasure in no uncertain terms. The pupil not only learned nothing, but on the paired comparison preference test previously described, rated the activity at the very bottom of the list.

In the next classroom study, we paid particular attention to the way a child used his peers as a source of help instead of using the reference book. Peers act as a resource in two ways: (1) when the learner is the player, they may serve in a tutorial capacity as information sources, or, (2) with the learner simply watching, they may serve as models. A child therefore could master the task at the learning center without using the information source at all. With the experience of the pilot study of tutoring, we were also sensitive to the possible detrimental effect of peer interactions.

The animal game was placed in a large Head Start Center for six days. The post test scores again were quite similar to earlier findings with about one third of the class reaching a high criterion. The oriented one-third in this study scored only half a point higher on the posttest than did the non-oriented children.

The game was used each day from 70 to 100 per cent of the time. On the large majority of rounds, more than one child was present in addition to the player. Sometimes there were as many as five or six. We had hoped to be able, on a card-by-card basis, to identify the source of help sought or received (with or without asking). However, the situation was too complex and we obtainted information on a more gross, per-round, basis. Even here, it was impossible to tell whether the child was asking for help; he would often get it without asking for it, sometimes when it was clear he didn't want it.

The record of different types of social interactions during this six day period is summarized in Figure 4. Using as the base the total number of rounds played by all children on a particular day, the graphs

are plotted in terms of the percentage of this figure for each day in succession. For all days combined, on 58 per cent of the rounds there was at least one other child present, sometimes as many as five or six. On 45 per cent of the rounds, there was a child watching and presumably learning from the activity of the player. Tutoring of one kind or another took place on 29 per cent of the rounds. Lastly, on 11 percent of all the rounds the observer noted some kind of interference, that is, where the player clearly tried to discourage, either physically or verbally, an attempted intervention, however well-meaning, by a peer.

It seems likely that the overall impact of this learning center, in terms of posttest performance, is to a large extent accomplished by the fact that these four and five year old youngsters learned from each other through being tutored or simply watching. Even through simply watching, without playing the game, many children may have learned much of what they later demonstrated.

Some of the informal anecdotal observations should be mentioned. We found that most children explored the box a good deal, sometimes putting two cards into it at once to see if this would work or trying to peek inside the box itself. Many youngsters seemed to enjoy finding pictures of the animals in the book as an activity in itself. Some matched the animal to the book instead of the procedure we expected. Since many children spoke Spanish at home, much Spanish was spoken as they worked. There was a good deal of verbalization such as, "I know where he lives," or "Aqui," Abajo," as the lookers-on helped some player.

Children frequently resisted being taught. Sometimes when a peer would tell the player where a card went, the child would put the card down on the tray and select another one instead. One little boy who was waiting said, "When it's my turn, don't show me." One child who was shown by

her friend where a card belonged still looked it up in the book apparently to verify it for herself. On occasion some children, when apparently they did not know where to put the animal, would sometimes open the book just a crack and peek into it as if, perhaps, this was verboten.

One particularly interesting child, Alice, was rated by teachers as the most withdrawn and shy youngster in the center, one often found in tears. She played the game a total of over thirty-five times in six days, an average of almost six times per day. Alice was a child who used the book constantly even after several days of playing. It was clear that the reference book no longer functioned as a teaching resource; many different personality and social needs were being met. However, the observer noted that during the latter part of the six-day period, Alice with her new-found competence was now interacting with the children more as she became a tutor, an activity which was to her a real source of satisfaction. In evaluating a learning resource, there are many outcomes which need to be considered.[1]

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[1]The incident is reminiscent of a frequently-observed nursery school phenomenon in which the insecure child for a large part of the morning is likely to end up on the swing, where he finds a less threatening social situation. Docia Zavitkovsky extended this illustration by pointing out that the same phenomenon may be observed among nursery school student teachers: at the beginning of the year the novice student teacher is likely to be found pushing children on the swings for most of the morning!

It is of interest to note some of the relationships which have been found in different studies of the learning center. While the number of cases in any class is too small to establish reliability, a number of correlations between .30 and .50 have stood up fairly well and are suggestive. Performance on the posttest is related to the total number of rounds played and to mental age on the Peabody Picture Vocabulary test. Preference for the game on the Paired Comparison Preference Test, described earlier, is related both to posttest performance and to the average number of games played per day, suggesting further validity of this test.

Concluding discussion

The relation between the work of the educational researcher and the real world of the classroom has been a topic of considerable concern. Skinner, almost two decades ago, advanced the compelling thesis that the reason psychology has had so little impact on education was not because the laboratory is unlike a classroom but because the classroom does not look like a laboratory. Most of the ensuing work in programmed instruction reflected this point of view and attempted to reduce uncontrolled sources of error variance as much as possible by shrinking the domain of learner-made decisions. The result, in all too many cases, was a drab, dull experience for the learner which some researchers identified and called "the pall effect."

Since this early period, there has been considerable progress in the development of programs which are successful in maintaining the attention of learners beyond the initial stage of novelty. One trend has been to relax the criterion of control by offering far more options. Many programs, for example, offer a variety of shorter sequences or modules, so that pupils and teachers may select a more appropriate order in accordance with local

demands. Even on a daily basis, a variety of activities are generally proposed to provide far more self direction by the learner.

Studies which have attempted to assess the value of giving the learner options in instructional programs have usually failed to establish reliable differences (cf. Campbell and Chapman, 1967). Often the strange conclusion is reached that, since there is no demonstrated advantage to giving the learner greater control, it is the programmer who might just as well make the instructional decisions! However, overlooked in such research is the fact that permitting the learner to make his own decisions is meaningless if, with reasonable amounts of support, he may markedly improve his decision-making skill. The learner is not always given adequate information about the nature and consequences of the options, and he usually receives no appropriate instruction in learning how to choose. It is also likely that the question of learner control involves the critical matter of individual differences, variables such as those looked at in the studies just reviewed.

Questions of learner autonomy require consideration of both specific features of the environment and the resources the learner brings to the setting. Where the situation poses an instructional goal, a variety of self instructional skills are important. At the Learning Research and Development Center at Pittsburgh a large number of specific self-management skills have been identified (Reynolds, 1971; Reynolds & Linehart, 1971), ranging from attention to task, self-evaluation and self-prescription to problem solving techniques such as seeking assistance from other materials, peers or the teacher. A major outcome from such long range programs may be the self-regulating behaviors which help the learner to profit more from his school environment. However, such skills are treated fairly closely within the context of the specific tasks encountered by the programs.

It is not yet clear as to what extent broad, general strategies, to be used by autonomous learners, may be taught (cf. Keislar, 1970). There may be considerable promise, however, in programs designed to modify the motivational patterns of learners (Adkins, et. al., 1971; DeCharms, 1972) so that the learner becomes more independent.

The self-management skill involved in the learning center reviewed in this chapter was information-seeking. Wide individual differences were found in the way young children engaged in self-prompting. Although no definitive evidence was obtained, it seems plausible that the way children attack this task of self-instruction reflects broader personality patterns. There was some support for a pattern of impulsivity in this task. Other findings, with low unreliable relationships, suggest the value of further exploration of the notion that children with high achievement motivation seek information in a more effective fashion than do either the anxious, dependent youngsters or their impulsive, quick-responding peers.

It seems most appropriate in designing goal-directed learning centers, that, among other things, a variety of task difficulties be presented. Children when given the option of doing so will seek out tasks commensurate with (1) their level of intellectual maturity (cf. Hunt's concept of match, 1961) and (2) their personality pattern in terms of such factors as impulsivity and achievement motivation. It is not clear, within an open framework, just what the nature of such a variety of task difficulties should be and how the child might be introduced and guided to use these resources most effectively for his own development. The design of the animal game learning center was such that the difficulty of the task

could be altered at any time by the learner; the child was free to get help and look up at any time. This adjustable difficulty feature may be an important one to include in many learning centers.

In his discussion of the relation between basic laboratory research and the classroom, Glass (1971) maintains that educational research should give up the goal of trying to get teachers to apply general conclusions from basic studies. Using Rothkopf's mathemagenic model as an example, he points out that the results of carefully done studies are subject to a host of variables in a classroom setting, a fact which mitigates against any practical use unless the specific conditions of that situation have been studied. He concludes that the utilization of basic knowledge requires the generation of instructional materials with demonstrated value. It is through the vehicle of such artifacts that basic research can have an impact in the classroom.

The highly applied strategy adopted for the collection of studies reviewed here is one of moving back and forth from a controlled laboratory setting to the classroom. It permits a continuous close relationship between the restricted conditions of the research laboratory and the complex situation in the school setting. The vehicle for transfer between the two is a set of standardized and replicable materials whose features can be adapted and modified as called for. The approach offers the opportunity to gain a classroom perspective upon what is happening in the laboratory, and conversely, to study under controlled conditions items of interest noted in the classroom. It involves a combination of an experimental approach and an observational, descriptive study of both individuals and classes. Although there is a tendency, certainly

apparent in this report, to look at too many different questions, the present illustration of the strategy underlines the problem of dealing in an analytic fashion with a component of the complex environment. Most of the studies simply raised questions for further exploration.

From the applied research point of view, the environmental component (in the present case, the learning center) is the independent variable, one which at best has only indirect control in the instructional process. Many researchers may feel that this "respect" for the learner's autonomy is quite unnecessary; learners will acquire independence just as well through procedures which are far more directive. On the other hand, those with a more humanistic bent are likely to denounce such careful planning and study of the instructional environment as a form of insidious subtle control. It is not likely that this question will be easily resolved.[2] In any event, the procedures by which such aspects of the environment were developed must be completely reported as in any scientific study. It is likely that such "controlled" studies may well be necessary to give the autonomous learner the tools he needs to deal with his own instruction.

The learning center devised for study seemed to be of considerable interest for most of these young children; over the period of roughly a week, it was in use from 75 to 100 percent of the time. The learning center was also effective as a means for self-instruction for a large proportion of these children. Although very few scored much above chance on the pretest,

[2]Kozol (1972), a spokesman for free schools, has pointed out the fallacy of assuming that the teacher can avoid influencing his students. He maintains that free schools are failing simply because they are not teaching.

evaluation of final performance revealed that approximately one-third of class attained a 90 percent level of mastery. While this record fails to meet the desired criterion often set for more structured programs, considering the completely optional nature of the instruction, the results appear quite satisfactory.

Preschool educators frequently maintain that informal experiences in a rich environment, quite apart from their superiority in fostering personal and social development, are fully as effective as "systematic instruction" in fostering pre-academic skills and other cognitive outcomes. Although preliminary evidence suggests the contrary point of view (schools get what they teach for), the evaluative study Planned Variations should throw considerable light on this question. However, it seems likely that careful study of the effectiveness of components of the environment should permit the design of more effective educational settings. Formative evaluation, illustrated by the present approach, may be far more important as a strategy to improve our educational facilities than a global, summative type of assessment.

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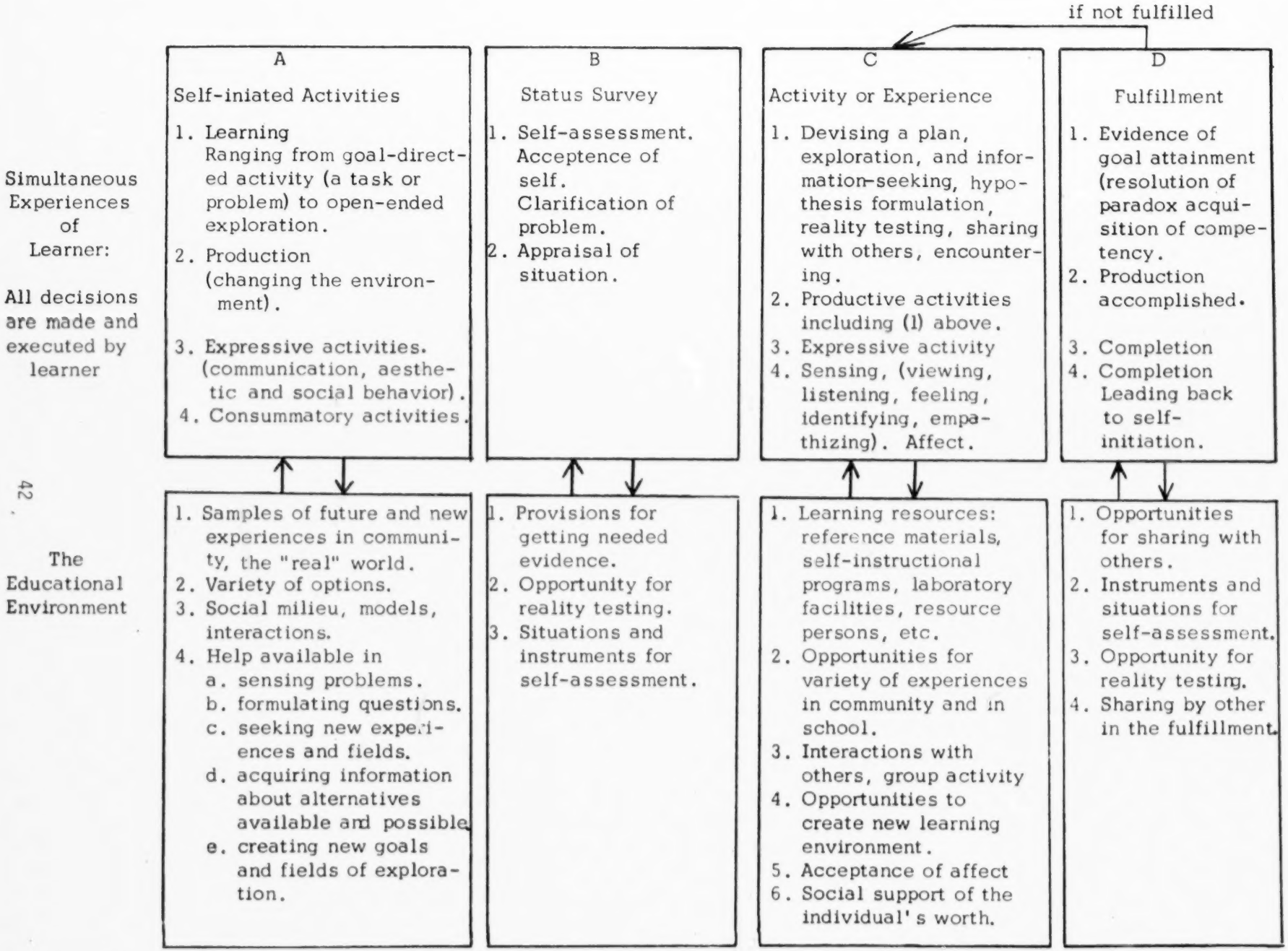
if not fulfilled
A
Self-iniated Activities
1. Learning
Ranging from goal-directed activity (a task or problem) to open-ended exploration.
2. Production
(changing the environment).
3. Expressive activities.
(communication, aesthetic and social behavior).
4. Consummatory activities.
B
Status Survey
1. Self-assessment.
Acceptence of self.
Clarification of problem.
2. Appraisal of situation.
C
Activity or Experience
1. Devising a plan, exploration, and information-seeking, hypothesis formulation, reality testing, sharing with others, encountering.
2. Productive activities including (1) above.
3. Expressive activity
4. Sensing, (viewing, listening, feeling, identifying, empathizing). Affect.
D
Fulfillment
1. Evidence of goal attainment (resolution of paradox acquisition of competency.
2. Production accomplished.
3. Completion
4. Completion
Leading back to self-initiation.
Simultaneous Experiences of Learner:
All decisions are made and executed by learner
The Educational Environment
1. Samples of future and new experiences in community, the "real" world.
2. Variety of options.
3. Social milieu, models, interactions.
4. Help available in
a. sensing problems.
b. formulating questions.
c. seeking new experiences and fields.
d. acquiring information about alternatives available and possible
e. creating new goals and fields of exploration.
1. Provisions for getting needed evidence.
2. Opportunity for reality testing.
3. Situations and instruments for self-assessment.
1. Learning resources: reference materials, self-instructional programs, laboratory facilities, resource persons, etc.
2. Opportunities for variety of experiences in community and in school.
3. Interactions with others, group activity
4. Opportunities to create new learning environment.
5. Acceptance of affect
6. Social support of the individual's worth.
1. Opportunities for sharing with others.
2. Instruments and situations for self-assessment.
3. Opportunity for reality testing.
4. Sharing by other in the fulfillment.

Figure 1. A Working Diagram Of The Relationships Between the Educational Environment And The Autonomous Learner.

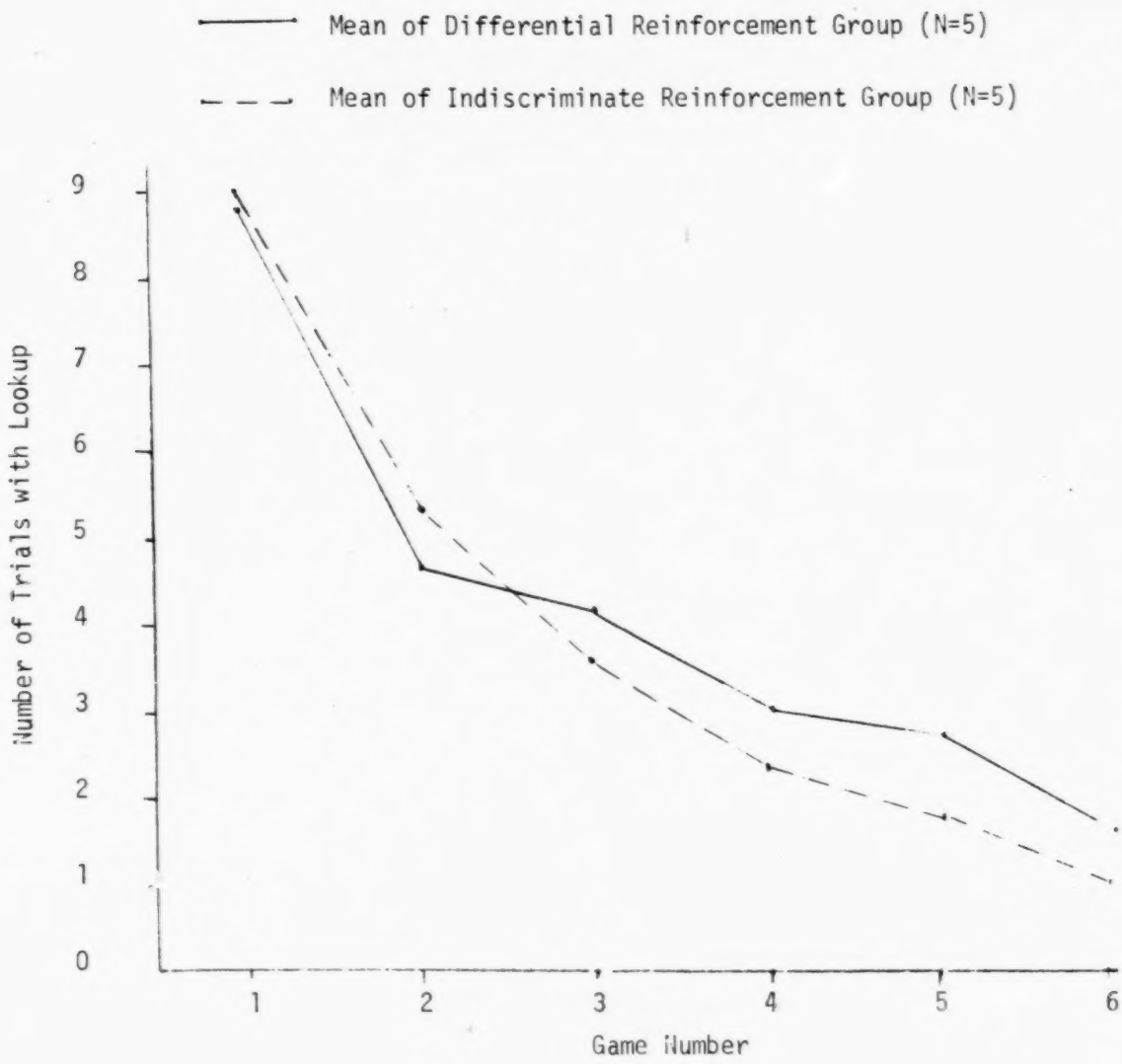

Figure 2. Mean Number of Trials Per Game where Reference was looked up for two groups.

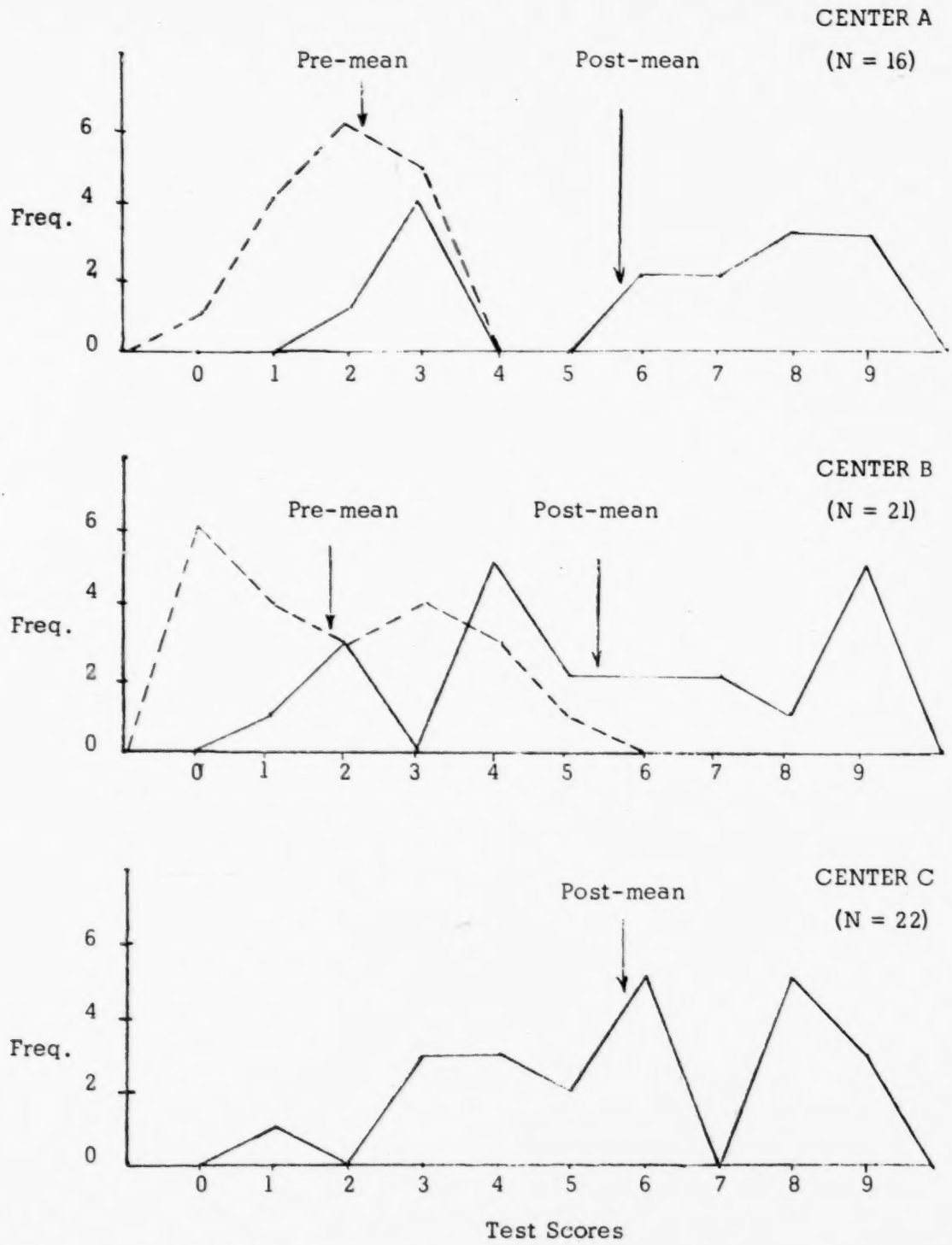

Figure 3. Pre And Posttest Distributions Of Scores At Three Head Start Centers Where Animal Game Was Left In Room For Four Days.

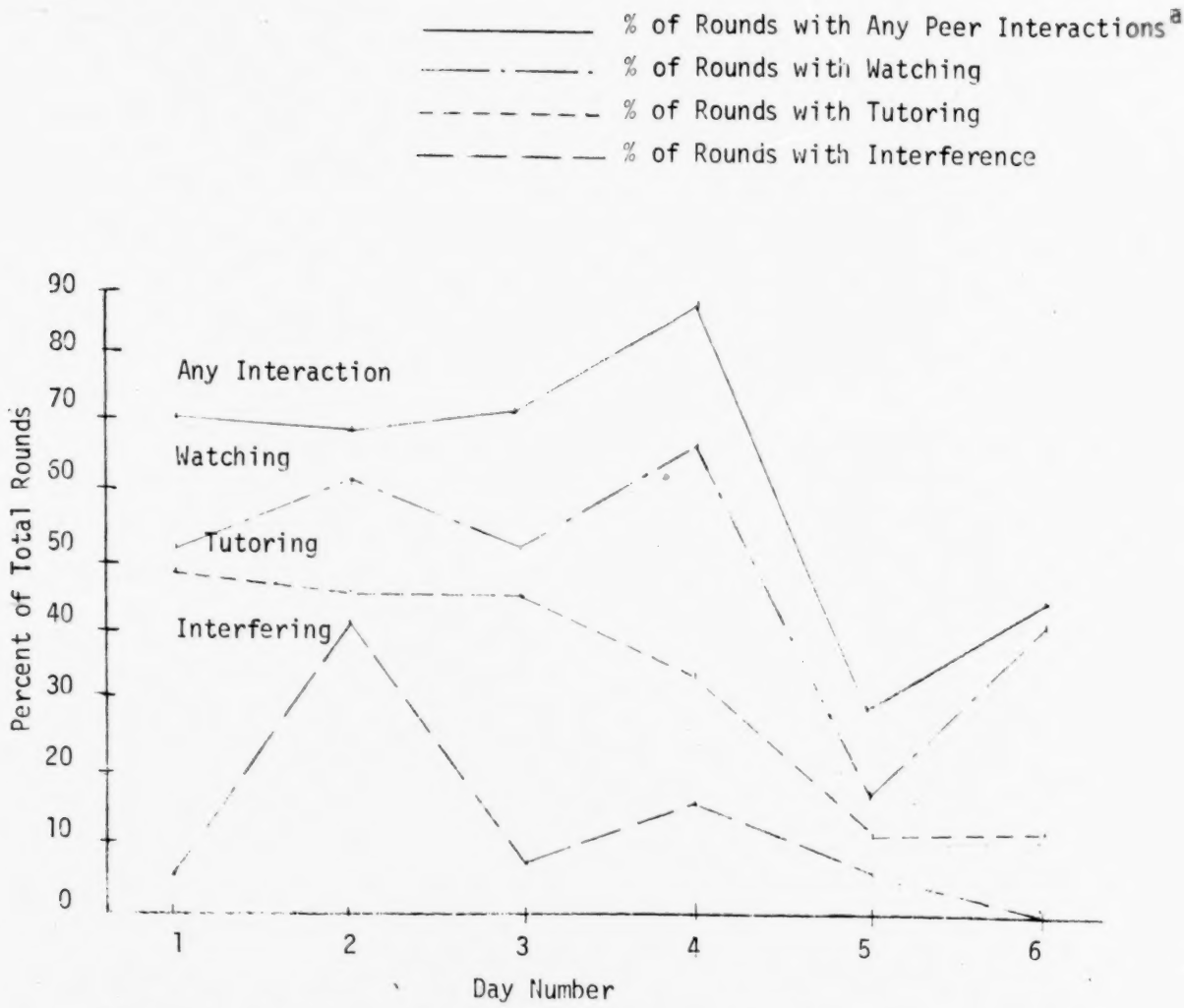

Figure 4. Percent of Total Rounds on Successive Days With Different Types of Peer Interactions.

a. The total reflects only one interaction per round. Since it was possible to have all three types of interactions during any one round, the combined values are greater than the total number of rounds. The average number of children at the game, in addition to the player, on successive days was 1.9, 2.5, 1.4, 1.8, 1.1, and 1.3.